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3. John W. Creswell, *Research Design: Qualitative & Quantitative Approaches*, Thousand Oaks, California: Sage Publications, 1994, 2.
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## Using the Airfield Simulation Tool for Airfield Capacity-Capability Assessment

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### Introduction

The Airfield Simulation Tool (AST) traditionally has been used for fleet-level analysis of transportation network flows.<sup>1</sup> For example, recent research completed by Captain Chris Randall at the Air Force Institute of Technology (AFIT) was used to assist the Air Mobility Command (AMC) Directorate of Logistics in assessing the impact of proposed operations on the health of the fleet. To improve this process, the directorate initiated the development of a mobility aircraft availability forecast simulation model to identify alternatives and associated impacts on aircraft availability, manpower, and cost. Randall's research identified and demonstrated how different base-support factors impact the availability of AMC aircraft. Simulation models were developed using the AST. However, the AST can be used for specific, wing-level analyses. This application is potentially quite useful for unit-level maintenance and operations managers in addressing capacity issues. The AST is a powerful tool for solving complex problems over a wide range of situations and is *user friendly* enough for many people to use effectively with a reasonable amount of training and practice.

This article presents the findings of an analysis performed by AFIT for a local logistics group commander more than a year ago. While the specifics of the analysis may no longer be timely (updates provided where relevant), this report represents the level and type of analysis that could be performed at any time by base personnel at units in similar situations. The purpose of this article is to describe the application of an available, relatively easy-to-use tool to assist logistics planners in performing analyses of airfield capacity and capability in order to achieve validation of new or existing missions and predict the ability of the base to process varying levels of workload.

With 24-hour tower operations and an abundance of available ramp space, Wright-Patterson AFB, Ohio, has opportunities for increased benefits from an optimized mix of airfield operations. In the spring of 2002, the 88<sup>th</sup> Logistics Group Commander wanted to explore the mix of existing operations with respect to proficiency training and contingency skills for his people. Without the right mix of operations, Wright-Patterson people could lose their warrior skill proficiency. This could be of special concern should Wright-Patterson be activated as an aerial port of embarkation (APOE) or be tasked to provide personnel or operational support for contingency and deployment operations. The 88<sup>th</sup> Log Group Commander solicited assistance from AFIT to determine his airfield's current capacity and capabilities in order to rationally seek the best potential increased workloads for the base. New business could provide 88<sup>th</sup> logistics personnel

with valuable training and experience to ensure they are ready for APOE activation, while potentially alleviating congested aerial ports across the Air Force.

To determine Wright-Patterson's current capacity, AFIT employed the AST of the US Transportation Command's (TRANSCOM) aerial port of debarkation (APOD) model. Several modifications and adaptations were made to allow the model to be used for this project's intent. Though this report focuses on the capacity of Wright-Patterson's freight operations, preliminary research was conducted on ways to increase the proficiency of air traffic controllers. This research successfully demonstrated the efficacy of the AST for assessing airfield capacity and capability. In addition, the research identified areas where underutilized capacity could be exploited to provide additional training and proficiency opportunities. The information contained in the final report could be used to help determine what, if any, new business should be solicited for Wright-Patterson's airfield. Examples of such additional new business would include any Air Force or Department of Defense air cargo workload that could be transited through the Wright-Patterson port or any air traffic that could be routed through the Wright-Patterson airspace (to include instrument approaches or landings). Any proposed new business over that of the maximum revealed capacity could be simulated with the AST to assess further risks and probability of failure before proceeding.

### Background

Wright-Patterson has undergone significant changes in operational mix since the departure of the LogAir hub in the 1990s. Tower traffic was decreased most recently with the departure of the 178<sup>th</sup> Fighter Squadron (Ohio Air National Guard F-16 unit) in April 2002. Wright-Patterson is home station to the 445<sup>th</sup> Airlift Wing (Air Force Reserve Command) and 47<sup>th</sup> Airlift Flight, comprising 18 C-141s and 6 C-21s.<sup>2</sup> Air traffic controllers currently experience low traffic counts, averaging only 100 per day,<sup>3</sup> and cargo freight personnel average only 2 air missions per week at 12 tons per mission.<sup>4</sup> Because of this limited peacetime traffic, the 88<sup>th</sup> Log Group Commander is concerned about personnel staying proficient in their warrior skills.<sup>5</sup> This concern is heightened further because of Wright-Patterson's role as an alternate APOE.

The intent of the research was to achieve two related objectives: first, perform a capacity analysis for the airfield and, second, evaluate the use of the AST as a tool for performing analyses of this type. This research comprised the first stage of a longer process to improve the efficiency, utility, and proficiency

of Wright-Patterson resources. The first phase would determine Wright-Patterson's excess capacity and resource capability. The objective of this phase was to map the feasible region of resource capabilities with respect to a variety of operational loads. This would give the 88<sup>th</sup> Log Group Commander a measure of confidence prior to entering the second phase of the project. The second phase would take the resulting data and use it to help solicit new business for the airfield in an effort to better utilize personnel and resources. This endeavor has the potential to be of mutual benefit to both the 88<sup>th</sup> Log Group Commander and the Air Force. While new business would serve to improve both the peacetime and wartime skill proficiency of the 88<sup>th</sup> Log Group personnel, it could help alleviate loads on aerial ports at other installations. The results of the first phase carry over into the second, as the potential additional workload must be analyzed from a capacity feasibility standpoint to prevent overloading of critically constrained resources.

## Methodology

The first phase of the project started with onsite interviews with subject-matter experts in affected areas and a review of past empirical data. Interviews and data both confirmed a suboptimization of existing capacity. For example, the performance of work statement from the existing freight contract yielded the following annual workload comparison (adjusted for spike activity) for gross air cargo (tons): 1,321 planned versus 974 actual, for a 73-percent utilization rate.<sup>6</sup>

To conduct the most accurate capability assessment possible, research was conducted to find a viable tool to model Wright-Patterson's current activity. The AST of the USTRANSCOM APOD model eventually was chosen. An assessment of AST is included in the section of results in this article. AST's viability in this type of project, along with limitations and associated recommendations, are provided.

Existing resources and a typical day's workload were modeled in an AST scenario. Home-station aircraft missions were simulated via a formatted file input. Transient aircraft were simulated via an AST-conducted random generation of aircraft, closely approximating historical airframe mixes as closely as possible. A 30-day simulation was then run for ten different iterations to determine the effect on the airfield. Although Wright-Patterson's weekend activity does not mirror that of its workweek, a 5-day simulation would not have yielded sufficient variability. AST does not account for weekends as it is primarily a mobility-planning tool and, thus, had to be adapted for this project's use. Running simulations for 30 straight days provided more variability and gave a better representation of the strain put on airfield resources caused by increased air traffic. A complete list of AST modeling assumptions particular to this project can be obtained by contacting the authors.

The first simulation was conducted to validate AST against Wright-Patterson's current activity. The model was validated using historical data, and AST reflected Wright-Patterson's ability to meet its current workload without any late aircraft departures because of constraints on airfield resources. These results were expected because of the low aircraft traffic experienced at Wright-Patterson. AST classifies a late aircraft as anything departing more than 15 minutes past its scheduled takeoff time. Scheduled takeoff times are based on standard ground times listed in Air Force Pamphlet (AFPAM) 10-1403.

Subsequent simulations then were conducted to determine the maximum cargo throughput of Wright-Patterson's airfield. C-5 cargo missions were incrementally added (with random arrival

rates) until a predetermined (considered intolerable by the log group commander) number of late aircraft departures began. At that point, subsequent simulations were conducted with different combinations of resources to determine the exact cause of late departures in order to identify the airfield's limiting factors. For example, the option to simulate materiel-handling equipment (MHE) and refueling truck breakdowns was turned on or off, and the amount of MHE and number of refueling trucks on hand were increased or decreased. Analyzing the effects of these mixes helped determine if the limiting factor was the actual amount of equipment on hand or the maintenance downtime associated with the airfield's heavier use.

Simulations were conducted for landing aircraft and unloading munitions at Wright-Patterson's hot cargo pads (HCP). This was done to plan for the possibility of only being able to obtain munitions missions as new business to the airfield. The hot cargo pads are twice the travel time from the cargo yard as the normal cargo plane parking area on the east ramp. Consequently, it was assumed that these missions would cause more late takeoffs because of the increased processing time, equipment operating hours, and associated maintenance downtime.

Once the maximum throughput of cargo *tonnage* was determined, subsequent simulations were conducted to determine the maximum cargo *aircraft* throughput for Wright-Patterson. Maximum C-5 planning loads (60 tons) were translated into equivalently loaded C-17s, C-141s, and C-130s.<sup>7</sup> This enabled the 88<sup>th</sup> Log Group Commander to know if increased cargo plane traffic would have a detrimental effect on other areas of his airfield besides freight operations; for example, refueling or maintenance operations.

Upon completion of the simulations, results were reviewed at weekly staff meetings, and the 88<sup>th</sup> Log Group Commander approved the closure of Phase I. The 88<sup>th</sup> Logistics Group subject-matter experts from freight and fuels operations validated the results. At that point, the Logistics Group began the search-and-analysis process for securing additional workloads for training and proficiency.

## Results of Capacity Analysis

A spreadsheet summary of all 28 completed simulations can be obtained by contacting the authors; representative summary results are included here. With current resources (two K-loaders, six refueling trucks, and three hydrant-servicing vehicles), AST revealed Wright-Patterson's maximum cargo throughput to be 60 tons for both munitions and nonmunitions loads, compliant with current 445<sup>th</sup> Airlift Wing, 47<sup>th</sup> Airlift Flight, and 178<sup>th</sup> Fighter Squadron activity levels. Overall results are described in two main findings below.

- **Sixty Tons (Nonmunitions), Each Duty Day, Offloaded at the East Ramp (Standard Parking Area) Hydrant Outlet Parking Spots.** These 60 tons can be delivered in any aircraft configuration (that is, one C-5, two C-17s, three C-141s, or five C-130s). Though resources were deemed sufficient to handle this increased workload, it would not come without some risk. AST revealed that 6.6 percent of simulated cargo aircraft missions were late because of K-loader unavailability, with 3 percent delayed for more than 8 hours (215 of 3,300). For R-11 refueling trucks, AST revealed that 0.2 percent of simulated aircraft missions were late because of truck unavailability (88 of 43,975). Finally, unavailability of

hydrant-servicing vehicles caused 0.4 percent of all hydrant-serviced simulated aircraft missions to be late (5 of 1,230).

- **Sixty Tons (Munitions), Every Other Day, Offloaded at the Hot Cargo Pad.** These 60 tons also can be delivered in any aircraft configuration. For these missions, the risk increases. AST revealed that 25 percent of simulated cargo aircraft were late because of K-loader unavailability (415 of 1,650), with 4.4 percent delayed more than 8 hours. For R-11 refueling trucks, AST revealed that 2 percent of simulated aircraft were late because of truck unavailability (869 of 43,038).

The increase in late aircraft missions because of K-loader unavailability seems dramatic at first, rising from 6.6 percent to 25 percent. However, the extreme delays caused by both K-loaders breaking (the biggest concern) remain fairly constant (4.4 percent versus 3 percent of late missions). The increase in the number of shorter delays is caused when only one of the two K-loaders is available with the extra time required to travel the longer distance from the cargo yard to the hot cargo pad (versus the east ramp standard parking area).

The increase in late aircraft missions because of R-11 refueling trucks seems dramatic at first look, rising from 0.2 percent to 2 percent. However, this increase rises exponentially as the cargo aircraft flowthrough escalates from one C-5 to five C-130s each day. These delays are nearly always 1 hour or less, so the impact is not necessarily unacceptable.

To help prevent late aircraft, Wright-Patterson maintenance practices should be evaluated to ensure equipment availability. As a possible suggestion, maintenance shifts could be added on weekends to prepare MHE and refueling trucks for use on the following Mondays. Since all AST simulations were run for 30 straight days, no equipment recovery time on weekends was factored in. Because of this adaptation, the number of late aircraft should be less under a real-world, 5-day-a-week scenario with weekend duty for maintenance people. In addition, for late departures, the true definition of late must be determined for each type of mission solicited. Aircraft will not always be required to depart within standard ground times listed in AFPAM 10-1403. If ground times could be relaxed, these occurrences would decrease substantially.

## Operational Risk Management

Increasing airfield business does not pose a risk solely in terms of late aircraft departures. A complete operational risk management assessment can be obtained from the authors. The major areas of concern are highlighted below:

- **Cargo Processing and Dock Clearance Speed.** The ability to build up pallets and clear the dock and cargo yard must be evaluated to ensure the airfield is ready for subsequent cargo missions. The ability to complete associated paperwork and required computer data entries, availability of adequate warehouse space, and pallet and net supplies also must be taken into account. As AST is an APOD tool, it does not model these areas.
- **HCP Location.** Certain mixes of munitions cargo would force the temporary closure of the golf course's driving range during offloading operations.<sup>8</sup> This could cause a substantial loss in funds for morale, welfare, and recreation. Other sites should be evaluated as possible alternate offloading areas for munitions. Note that this limitation represents a *peacetime only* consideration.
- **Wright-Patterson Alternate APOE Designation.** Any new business brought to Wright-Patterson could be interrupted for

long periods of time during contingencies. Any new missions taken on by the base potentially would be of a lower priority to the contingency missions already tasked.

- **Existing Freight Contract.** According to the contract's performance of work statement, AST-calculated maximum throughput quantities would be 1,180 percent more than the planned workload for everyday missions and 708 percent more than for every-other-day HCP missions.<sup>9</sup> The effect on contract costs must be determined to make a cost-benefit analysis.
- **Startup Effect.** The long period of underutilization at Wright-Patterson could cause sluggish initial performance if workloads increase.

## Additional Workload

Although this report focuses on Wright-Patterson's capacity for expanded cargo missions, preliminary research was conducted on ways to increase skill proficiencies of the base's air traffic controllers. Wright-Patterson temporarily hosted the 178<sup>th</sup> when its operations were moved from Buckley Field in Columbus, Ohio. The increased traffic counts resulting from the temporary relocation of the 178<sup>th</sup> were extremely beneficial to Wright-Patterson controllers. The departure of the 178<sup>th</sup> in April 2002 eventually could decrease the skill proficiency of air traffic controllers, and opportunities to bring new business to the airfield will be explored by the 88<sup>th</sup> Log Group to counter any negative effects.<sup>10</sup> AST simulations reveal that Wright-Patterson could double the amount of fighter traffic it currently experiences.

The addition of a global positioning satellite (GPS) approach at Wright-Patterson is one possibility for increasing air traffic counts. It is estimated that less than 20 percent of all military installations possess GPS approaches.<sup>11</sup> It is likely that such an approach at Wright-Patterson could entice numerous training missions to the airfield for pilots to certify and recertify on those types of approaches.

The last area for exploitation is the Tower Simulation System (TSS) currently under development. The 360-degree simulator provides an excellent, life-like training environment that can simulate any condition at any airfield.<sup>12</sup> The addition of this simulator at Wright-Patterson could be extremely beneficial, as it would provide a low-risk training environment for initial and refresher controller training. The simulator could be invaluable because of Wright-Patterson's low traffic count, providing life-like training in the absence of real-world missions to the airfield.

The TSS is required to be ready for training on 30 September 2002. Wright-Patterson is ranked fifth out of six bases on the Air Force Materiel Command (AFMC) priority list to receive the TSS. The low ranking is caused by the higher number of trainees and traffic counts at other installations. Only two to four simulators will be bought in fiscal year (FY), and 20-30 will be requested for FY03. With 94 sites eventually receiving the TSS, Wright-Patterson would have to wait a long time at the present ranking.<sup>13</sup> A joint effort between AFIT and the 88<sup>th</sup> Log Group could possibly raise Wright-Patterson's receipt priority. AFIT could provide justification that the close proximity of their engineering experts would assist greatly in TSS beta testing. The 88<sup>th</sup> could justify that maintaining proficiency at lower traffic-count bases is just as important as, if not more than, training new recruits at bases with higher traffic counts. The rationale would be that higher traffic counts naturally lend to faster training and better maintenance of air traffic controller proficiency and, therefore, the TSS would be needed more at bases with low traffic counts.

## Results of AST Analysis

To determine Wright-Patterson's airfield capacity, AFIT used the AST, a subcomponent of the TRANSCOM APOD model. As such, it is designed to evaluate an APOD's ability to meet its contingency flowthrough tasking. This presented some difficulty in adapting the model for day-to-day, noncontingency use. Another limitation of AST is, since it is an APOD tool, there is no way to assess an airfield's ability to prepare outgoing cargo in time to meet scheduled aircraft departures.

Cooperation between AFIT and TRANSCOM-affiliated personnel made the completion of this project possible. The assistance of Lieutenant Colonel Robert Brigantic, Jean Mahan, and Dr Travis Cusick were invaluable in completing this research effort. Their cooperation extended to a staff assistance visit conducted on 13 February 2002, and continuous interaction resulted in several improvements and modifications to the AST software. These improvements made the model easier to use and the simulation results easier to analyze.

User analysis of simulation results reveals AST to be a viable tool to assess airfield capacity. To validate this assessment, a working maximum-on-ground (MOG) calculation was requested through AFMC personnel. The purpose of requesting a working MOG calculation is to compare it to baseline results of the AST simulations, thereby serving to validate its viability.

Before listing recommended improvements to the AST, it must be recognized that the AST was not designed for performing this type of analysis. Though AST was able to be adapted for this project's intent, several features could be developed to make it easier to use for nonmobility or APOE purposes. The following is a list of findings and recommendations to improve the use of the AST for similar projects in the future. Areas of concern include model Fidelity, Execution, and Interpretation.

### Fidelity

- **Observation 1.** Since AST is not designed for peacetime operations, weekends cannot be accounted for during random generation of aircraft. This can be remedied for most missions by generating aircraft via formatted files. However, this was not possible for transient aircraft. AST assumes a constant availability rate for all airfield resources, 24 hours a day. This made it difficult to model a normal 8-hour workday. To generate transient aircraft arrivals randomly, AST takes a desired number of arrivals (determined by the user) and uses a mean time between arrival formula. These arrivals occur at a normal rate of distribution throughout the 24-hour period. AST has no way to condense a desired daily number to enable the majority of arrivals to fit into normal operating hours. Although Wright-Patterson is open 24 hours, airfield operating hours were set at 0745-1630 to coincide with the availability of all airfield resources. Since subject-matter experts stated the majority of transient aircraft land during normal duty hours, random generation of transient aircraft was set to land the approximate historical transient aircraft per day within the 8.75-hour period. Generating transient aircraft via a formatted file input would have been too labor intensive and too hard to change for subsequent simulations. This possibly overworked simulated resources during normal duty hours, potentially inflating late departure occurrences. This also prevented the ability to evaluate after-hours support or take this level of capacity into consideration.
- **Observation 2.** Since AST is part of the APOD model, APOE peculiarities are not modeled. For example, cargo for onload

operations is assumed to be wrapped and strapped, with all associated paperwork and computer entries completed. No delays are built into the model to account for these actions. This is not practical in real-world scenarios, as numerous problems could prevent cargo from being ready to ship. This artifact will result in project owners having to assess their ability to prepare cargo independently in time to meet scheduled aircraft departures. It is recommended that an APOE version of the AST be developed, reversing Army Enabler duties; include an option for the percentage of cargo ready to move versus that cargo which requires processing actions; and include a delay time for those that do.

- **Observation 3.** Formatted file inputs do not have a column to designate flights as hazardous cargo missions. A user can designate all of an aircraft type to park only at a hot cargo pad as a remedy. However, this presents a problem if not all aircraft in the mission design series will be required to carry hazardous cargo. This produces an inability to evaluate mixes of hazardous and nonhazardous cargo flights by the same mission design series. The user must use other mission design series as substitutes for desired mission design series, leading to possible confusion and error when analyzing simulation results. This could be addressed through the creation of an ability to specify each formatted file aircraft as either a hazardous or nonhazardous mission. However, a workaround exists in that, when the simulation of hazardous cargo is enabled in AST, the aircraft generated from flat files follow the same hazardous percentages found in the aircraft and details window that internally generated aircraft follow. Therefore, by aircraft type, the user can specify the probability that any individual aircraft will contain hazardous material.
- **Observation 4.** Since AST is part of the APOD model, it is most concerned with the simulation of cargo aircraft. As such, it does not model fighter aircraft. Though the user has the ability to model customized aircraft to simulate fighter traffic, this drawback posed a problem in the area of refueling. AST assumes that all trucks are full of fuel as they wait to service their next aircraft. This means that they go back to the fill stand to refuel after every aircraft servicing. This creates unnecessary travel when refueling fighter aircraft, as one full R-11 can service three to five F-16s before needing to return to the fill stand. This resulted in the modeling of unnecessary travel back to fill stands by R-11 trucks, causing delays in servicing and the potential for late aircraft departures. Though this can give a measure of confidence that simulation results with no late departures can be relied on, a true capacity is impossible to measure. The user also had to calculate the number of unnecessary trips back to the fill stand to compensate for the increased usage hours. The mean time between failure rates for R-11 trucks was adjusted accordingly. Since AST models K-loaders to go immediately to the next aircraft in need, perhaps the same could be done for petroleum, oil, and lubricant trucks. A refill level for the R-11 could be established and a decision point implemented on whether or not to send a truck to the next aircraft requiring service or back to the fill stand for refueling.

### Execution

- **Observation 5.** Airfield and aircraft random number seeds must be set manually during multiple iterations. Subsequent iterations begin incrementally from that seed number (for example, ten iterations starting at seed number 20 continue

with seed numbers 21, 22, 23, 24...29). With 1,000 seed numbers for each field, this seems to limit the range of reported variance. AST could be enabled to proceed with multiple iterations through random seed number assignments versus incrementally from a manually set seed. In addition, some seed numbers crash the simulations while others work fine. Multiple iterations were set to only ten because of wasted time when crashing after trying higher numbers. Both of these problems required manual workarounds and resulted in significant nonvalue-added time on the part of the user. If the synchronization of random number streams is not an issue (when predicting the utility of a single model, for example, vice comparing alternative configurations), this is not necessary.

- **Observation 6.** Users must input standard ground times. It may be helpful if the model could calculate this automatically based on fuel and cargo load plans. This would prevent the user from having to change the standard ground time for random aircraft generation or departure times in formatted file aircraft generation. Simply setting all standard ground times to zero would result in aircraft leaving as soon as their processes are complete; however, this results in all aircraft reflecting as late in output result files. Changing departure times in formatted files for added cargo aircraft in subsequent simulations was tedious and time-consuming. The creation of an option to allow for automatic calculation on standard ground times based on fuel and cargo loads would solve this issue.

### Interpretation

- **Observation 7.** The actual root cause for late aircraft departures is sometimes hard to determine. In the Summary.Out files, the total number of late aircraft is given (*Break or No Break*) with no breakdown of reasons. Aircraft can have delay times in more than one category, and reference to several of the output files is required to narrow down the exact reasons for late aircraft. In some instances, the best and only way to ascertain the root cause is to change the airfield parameters and run subsequent simulations to determine if the late occurrences still occur. This caused an occasional exorbitant amount of time analyzing results to determine reasons for late aircraft departures. If there was a way to categorize root reasons for late aircraft and reporting total numbers by cause in Summary.Out files, it would speed interpretation and analysis greatly. This observation actually resulted in several AST modifications made by the contractor. The addition of two aircraft delay categories in ACDATA.Out files was most helpful (delay for refueling truck and delay for hydrant). In addition, Summary.Out files list average delay times for different categories. However, this average is applied to all aircraft, not just late departing aircraft. This quick snapshot underestimates the effect of delays in these areas, as a very small average actually can comprise numerous lengthy delays. Categorize root reasons for late aircraft and report total numbers by cause in Summary.Out files. If keeping total average delay categories, that average must be calculated from late aircraft only.

Overall, the AST was used successfully to model peacetime operations at Wright-Patterson. While there are several improvements that could be made to ease the use of the software, the model generated valid, useful results. The analysis of logistics capacity and capabilities of an aerial port (either *peacetime* or *wartime*) provides extremely valuable information to Air Force leadership.

## Conclusions and Recommendations

The AST, although primarily used for mobility planning, is a valid assessment tool to measure baseline airfield capacity. By changing input parameters in successive simulations, certain effects could be predicted and modeled. Several difficulties encountered during this analysis were addressed and resolved by the model development team at USTRANSCOM. Model performance and ease of use improved greatly during the short period of this study and is expected to improve even more. Based on these results and their corresponding analyses, it is believed AST provided an accurate account of Wright-Patterson's capability to handle the increased workloads outlined in the simulation parameters. This result could be applied to any airfield and would provide valuable information about logistics capacity.

Wright-Patterson undoubtedly can handle increased air traffic, either through additional cargo missions or smaller aircraft. An appropriate mix of cargo and tactical aircraft would be desired to ensure proficiency in both areas of freight and tower operations. During the logistics buildup in preparation for and support of Operation Iraqi Freedom, Wright-Patterson was tasked to provide en route port services in support of multiple deployment taskings. Information derived as a result of this analysis was very helpful to Wright-Patterson in supporting these operations.<sup>14</sup> Decisions were implemented with respect to improving capacity (explosive safety zones redesign, scheduling, resource allocation, and so forth) rapidly and smoothly, and the effects of changes to operations were predictable and relevant.

In the event new business is unobtainable, alternatives must be explored to increase training opportunities and ensure warrior skill proficiency. In addition to obtaining a new GPS approach and the TSS, inhouse training scenarios and exercises could be developed in more detail, with more realism and increased frequency and duration. Mockup cargo pallets could be constructed and loaded onto C-141 schoolhouse aircraft, with computer data inputs loaded into dummy global transportation network databases.

The 88<sup>th</sup> Log Group should proceed to solicit new business for Wright-Patterson's airfield. New business should be undertaken incrementally and with caution. Careful attention should be given to the risks outlined in the operational risk management assessment. Any new business scenario should be modeled using the AST and simulated at least at 100 iterations to determine possible effects on airfield resources.

Finally, USTRANSCOM should consider implementing some or all the recommendations presented in the AST evaluation phase of this investigation. Although AST was successfully adapted for nonmobility and APOE use, recommended changes could result in a new AST version designed exclusively for those purposes. The ability to model aerial port operations at this level of detail and accuracy could provide a core competitive advantage in managing these complex operations.

### Notes

1. Capt Christian E. Randall, An Analysis of the Impact of Base Support Resources on the Availability of Air Mobility Command Aircraft, MS Thesis, AFIT, Wright-Patterson AFB, Ohio, Mar 04 (AFIT/GLM/ENS/04-15).
2. Author's e-mail interviews with Col James Blackman, 445<sup>th</sup> Operations Group, Wright-Patterson AFB, Ohio, 27 Feb 02, and Lt Col Richard Baker, 47<sup>th</sup> Airlift Flight, Wright-Patterson AFB, Ohio, 17 Apr 02.

(continued on page 47)

headquarters will be reduced. Brigades and portions of divisions will be organized into a modular force called units of action. These will contain the traditional maneuver battalions, along with some combat support and combat service support traditionally provided by divisional or corps units. The Army envisions three types of maneuver units of action: armored units of action will have about 3,800 persons and 1,000 vehicles; infantry units of action will have about 3,000 persons, and Stryker units of action will have about 4,000 persons. There also will be aviation units of action and sustainment units of action. All told, there will be 21 infantry units of action, 22 armored units of action, and 5 SBCTs. The Army's goal is to have 48 active component units of action and 32 National Guard units of action. The higher level command and support organization for the units of action will be called a unit of employment (UE) (x). This one level of command will be able to conduct many of the same command and control missions being performed by the two levels of command associated with divisions and corps. A UE (x) will be capable of commanding at least six units of action, to include a marine expeditionary brigade or a portion thereof. A different type of UE—this one currently designated with a (y) versus an (x)—will serve at a higher level than the UE (x). The UE (y) will conduct many of the command and control missions formerly provided by the two levels associated with corps and ASCCs.

### Additional Logistics Resources


In addition to the excellent logistics-related databases that LOGSA maintains, the Army has other Web sites that are invaluable to the joint logistician. For instance, Army Knowledge Online (AKO) at [https://www.us.army.mil/portal/portal\\_home.jhtml](https://www.us.army.mil/portal/portal_home.jhtml) is the official portal serving as the primary information management tool for the Army. All soldiers, Army retirees, DoD contractors, members of Federal agencies, and members of the other services can apply for a password. Having an AKO password allows users access to many other logistics portals managed by Army activities. The Army Command and General Staff College's Department of Logistics and Resource Operations maintains an informative Web site at <http://www-cgsc.army.mil/dlro/> and so does CASCOS at <http://www.cascom.army.mil/>.

## Conclusion

The Army is structured to deploy to remote locations worldwide as part of a joint force. It has unique logistics challenges because of the distributed, noncontiguous methods of its employment. Providing logistics support to Army forces is made even more difficult by the diversity of equipment and by the dispersal of its forces. The Army is undergoing a major transformation of its force so that it can deploy large forces much more rapidly than it has in the past.


### Notes

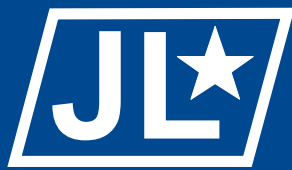
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2. AMC, Major Subordinate Commands [Online] Available: [www.amc.army](http://www.amc.army).
3. Aerospaceweb [Online] Available: [www.aerospaceweb.org](http://www.aerospaceweb.org).
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("Using the Airfield Simulation Tool for Airfield Capacity-Capability Assessment" continued from page 42)

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4. Author's interview with Duane Ward, representative for freight contractor, Wright-Patterson AFB, Ohio, 22 Jan 02.
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# AIR FORCE JOURNAL of LOGISTICS

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A part grouping system, however, effectively leverages a supply chain by arranging the production of individual items into groups that are based on common manufacturing processes.

## Part Grouping

Angioplasty for the Supply Chain

**H**ey, *loggie* warfighter, your aged weapon systems are full of *tired iron*, you have diminishing manufacturing sources for mission critical spare parts, your industrial base is getting colder, and lead times are getting longer each day.

**Agile Combat Support**

Logistically, you have hardening of the arteries.



Colonel Michael C. Yusi, USAF

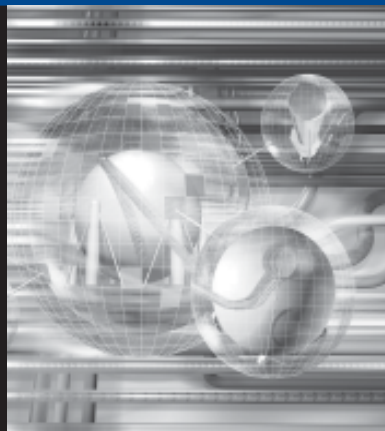
The Editorial Advisory Board selected "Part Grouping"—written by Colonel Michael C. Yusi, USAF, Vol XXVII, No 1—as the most significant article to appear in the *Air Force Journal of Logistics* in 2003.

The Japanese were not the first to ignore the importance and vulnerability of logistics.

## Oil Logistics In the Pacific War

Lieutenant Colonel  
Patrick H. Donovan, USAF

As long ago as 1187, history shows that logistics played a key part in the Muslim's victory over the Crusaders at the Battle of Hittin. The Muslim commander Saladin captured the only water source on the battlefield and denied its use to the Crusaders.



The Editorial Advisory Board selected "Oil Logistics in the Pacific War"—written by Lieutenant Colonel Patrick H. Donovan, USAF—as the most significant article to appear in Vol XXVIII, No 1 of the *Air Force Journal of Logistics*.

Lieutenant Colonel Joseph E. Diana, USAF

## Improving Bare-Base Agile Combat Support

A Comparative Analysis Between Land Basing and Afloat Prepositioning of Bare-Base Support Equipment

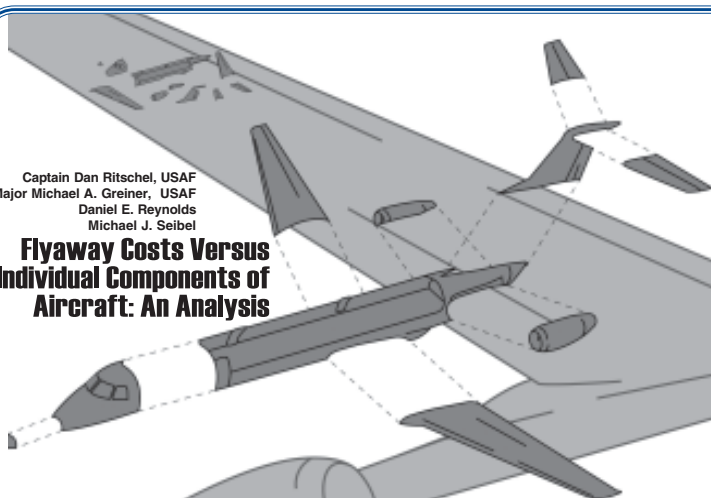
To improve Air Force agility in establishing bare-base operations, RAND and the Air Force Logistics Management Agency analyzed current conditions separately and recommended potential solutions.



The Editorial Advisory Board selected "Improving Bare-Base Agile Combat Support: A Comparative Analysis Between Land Basing and Afloat Prepositioning of Bare-Base Support Equipment"—written by Lieutenant Colonel Joseph E. Diana, USAF—as the most significant article to appear in Vol XXVIII, No 2 of the *Air Force Journal of Logistics*.

Captain Dan Ritschel, USAF  
Major Michael A. Greiner, USAF  
Daniel E. Reynolds  
Michael J. Seibel

## Flyaway Costs Versus Individual Components of Aircraft: An Analysis



The staff of the *Air Force Journal of Logistics* selected "Flyaway Costs Versus Individual Components of Aircraft: An Analysis"—written by Captain Dan Ritschel, USAF; Major Michael A. Greiner, USAF; Daniel E. Reynolds, and Michael J. Seibel, Vol XXVII, No 4—as the best article written by a junior officer to appear in the *Air Force Journal of Logistics* in 2003.